CLAIMS

1) A rear-drive vehicle (1) comprising:

a self-locking differential (9);

an engine (4) producing a drive torque (Tm) which is transmitted to the rear drive wheels (3) by the self-locking differential (9);

an accelerator pedal (14) which modulates the drive torque (Tm) generated by the engine (4);

a brake pedal (13) which modulates a brake torque acting on the vehicle (1);

a number of sensors (16) for real-time detecting respective dynamic parameters of the vehicle (1);

a regulating device (24) for regulating the lock percentage (%L) of the differential (9); and

a central control unit (15) for controlling the regulating device (24) to regulate the lock percentage (%L) of the differential (9) as a function of the dynamic parameters of the vehicle (1);

the vehicle (1) is **characterized in that** when cornering the central control unit (15) reduces the lock percentage (%L) of the differential (9) when the accelerator pedal (14) is pressed and increases the lock percentage (%L) of the differential (9) when the accelerator pedal (14) is released.

2) A vehicle (1) as claimed in Claim 1, wherein the self-locking differential (9) comprises a box body (17); a bevel gear pair (18) housed in the box body (17), and

which transmits the drive torque (Tm) to the two rear drive wheels (3) by means of respective axle shafts (10); and a lock device (19) for partly locking one axle shaft (10) with respect to the box body (17); the lock device (19) comprising a clutch (20) in turn having a number of disks (23) integral with one of the axle shafts (10), and a thrust chamber (21) filled with a fluid (22) under pressure (P) to exert variable axial thrust on the disks (23).

3) A vehicle (1) as claimed in Claim 2, wherein the regulating device (24) regulates the pressure (P) of the fluid (22) inside the thrust chamber (21).

4) A vehicle (1) as claimed in Claim 3, wherein the regulating device (24) comprises a solenoid valve (31) for selectively connecting the thrust chamber (21) to a tank (25) into which the fluid (22) is drained, or to a tank (29) for supplying the fluid (22) under pressure (P).

5) A vehicle (1) as claimed in Claim 4, wherein the central control unit (15) estimates a target value of the lock percentage (%L) of the differential (9) as a function of the dynamic parameters of the vehicle (1), estimates a target value (Prif) of the pressure (P) of the fluid (22) inside the thrust chamber (21) as a function of the target value of the lock percentage (%L) of the differential (9), and controls the solenoid valve (31) to apply inside the thrust chamber (21) the target value (Prif) of the pressure (P) of the fluid (22).

6) A vehicle (1) as claimed in Claim 5, wherein the regulating device (24) comprises a first sensor (36) for detecting the value of the pressure (P) of the fluid (22) inside the thrust chamber (21), and a second sensor (37) for detecting the value of the current (I) circulating through the solenoid valve (31); the central control unit (15) controlling the value of the pressure (P) of the fluid (22) inside the thrust chamber (21) by means of a first control loop employing as a feedback variable the value of the pressure (P) of the fluid (22) inside the thrust chamber (21), and a second control loop within the first control loop and employing as a feedback variable the value of the current (I) circulating through the solenoid valve (31).

7) A vehicle (1) as claimed in Claim 1, wherein the central control unit (15) controls the regulating device (24) to regulate the lock percentage (%L) of the differential (9) as a function of the travelling speed (V) of the vehicle (1), the turning angle (Dvol) of the vehicle (1), the yaw speed (Psip) of the vehicle (1), the lateral acceleration (Ay) of the vehicle (1), the longitudinal acceleration (Ax) of the vehicle (1), the rotation speed (WrearL, WrearR) of each rear drive wheel (3), the position (Pacc) of the accelerator pedal (14), the position (Pbra) of the brake pedal (13), and the drive torque (Tm).

8) A vehicle (1) as claimed in Claim 1, wherein the reduction in the lock percentage (%L) of the differential

(9) is proportional to the lateral acceleration (Ay) of the vehicle (1), the speed (V) of the vehicle (1), and the drive torque (Tm) of the engine (4).

9) A vehicle (1) as claimed in Claim 1, wherein the central control unit (15) reduces the drive torque (Tm) of the engine (4) to limit the power oversteering effect.

10) A vehicle (1) as claimed in Claim 1, wherein, when cornering at substantially steady speed, the central control unit (15) estimates the road grip of the wheels (2, 3), zeroes the lock percentage (%L) of the differential (9) when the road grip of the wheels (2, 3) is far from the grip limit, and gradually increases the lock percentage (%L) of the differential (9) when the road grip of the wheels (2, 3) nears the grip limit.

11) A vehicle (1) as claimed in Claim 10, wherein the central control unit (15) reduces the lock percentage (%L) of the differential (9) to zero when the road grip of the wheels (2, 3) is almost at the grip limit.

12) A vehicle (1) as claimed in Claim 10, wherein, as the road grip of the wheels (2, 3) nears the grip limit, the central control unit (15) gradually increases the lock percentage (%L) of the differential (9) in proportion to the value of the lateral acceleration (Ay) of the vehicle (1) and the value of the speed (V) of the vehicle (1).

13) A vehicle (1) as claimed in Claim 10, wherein the central control unit (15) zeroes the lock percentage (%L) of the differential (9) when the value of the

turning angle (Dvol) of the vehicle (1) is substantially directly proportional to the value of the lateral acceleration (Ay) of the vehicle (1), and gradually increases the lock percentage (%L) of the differential (9) when no substantially direct proportion relationship exists between the value of the turning angle (Dvol) of the vehicle (1) and the value of the lateral acceleration (Ay) of the vehicle (1).

14) A vehicle (1) as claimed in Claim 10, wherein the central control unit (15) estimates the road grip of the wheels (2, 3) by estimating the value of the lateral acceleration (Ay) of the vehicle (1).

15) A vehicle (1) as claimed in Claim 10, wherein the central control unit (15) estimates the road grip of the wheels (2, 3) by estimating the value of the turning angle (Dvol) of the vehicle (1) and value of the lateral acceleration (Ay) of the vehicle (1).

16) A vehicle (1) as claimed in Claim 1, wherein, when driving along a substantially straight route, the central control unit (15) zeroes the lock percentage (%L) of the differential (9) in normal driving mode, and gradually increases the lock percentage (%L) of the differential (9) in sport driving mode.

17) A vehicle (1) as claimed in Claim 1, and comprising two axle shafts (10), each connecting the self-locking differential (9) mechanically to a respective rear wheel (3); and two torque sensors (16), each of which is connected to the central control unit

(15), is fitted to a respective axle shaft (10), and real-time detects the value of the torque transmitted by the self-locking differential (9) to the respective rear wheel (3) via the relative axle shaft (10); the central control unit (15) controlling the regulating device (24) to regulate the lock percentage (%L) of the differential (9) as a function of the value of the torque transmitted by the self-locking differential (9) to each rear wheel (3).

18) A vehicle (1) as claimed in Claim 17, wherein each torque sensor (16) is electromagnetic, and measures electromagnetically the torsional deformation of the respective axle shaft (10) to determine the value of the torque transmitted by the axle shaft (10) to the relative rear wheel (3).

19) A vehicle (1) as claimed in Claim 17, wherein the central control unit (15) predicts time changes in the angular rotation speed of each rear wheel (3), using the value of the torque transmitted by respective axle shaft (10), and controls the regulating device (24) to regulate the lock percentage (%L) of the differential (9) as a function of future time changes in the angular rotation speed of each rear wheel (3).

20) A vehicle (1) as claimed in Claim 17, wherein the central control unit (15) estimates a target value of the lock percentage (%L) of the differential (9) as a function of the dynamic parameters of the vehicle (1), and controls the regulating device (24) by means of a

feedback control loop employing as a feedback variable the value of the lock percentage (%L) of the differential (9).

21) A vehicle (1) as claimed in Claim 20, wherein the regulating device (24) comprises a solenoid valve (31) controlled to vary the lock percentage (%L) of the differential (9), and a second sensor (37) for detecting the value of the current (I) circulating through the solenoid valve (31); the central control unit (15) controlling the regulating device (24) by means of a first control loop employing the value of the lock percentage (%L) of the differential (9) as a feedback variable, and a second control loop within the first control loop and employing as a feedback variable the value of the current (I) circulating through the solenoid valve (31).

22) A vehicle (1) as claimed in Claim 17, wherein the central control unit (15) estimates a target value of the lock percentage (%L) of the differential (9) as a function of the dynamic parameters of the vehicle (1), and controls the regulating device (24) by adding a feedback control loop employing the value of the lock percentage (%L) of the differential (9) as a feedback variable, and a direct open control loop employing the target value of the lock percentage (%L) of the differential (9) as a control variable.

23) A vehicle (1) as claimed in Claim 22, wherein the regulating device (24) comprises a solenoid valve

(31) controlled to vary the lock percentage (%L) of the differential (9), and a second sensor (37) for detecting the value of the current (I) circulating through the solenoid valve (31); the central control unit (15) controlling the regulating device (24) by means of a first control loop employing the value of the lock percentage (%L) of the differential (9) as a feedback variable, and a second control loop within the first control loop and employing as a feedback variable the value of the current (I) circulating through the solenoid valve (31).

24) A rear-drive vehicle (1) comprising:

a self-locking differential (9);

two axle shafts (10), each connecting the self-locking differential (9) mechanically to a respective rear wheel (3);

a number of sensors (16) for real-time detecting respective dynamic parameters of the vehicle (1);

a regulating device (24) for regulating the lock percentage (%L) of the differential (9); and

a central control unit (15) for controlling the regulating device (24) to regulate the lock percentage (%L) of the differential (9) as a function of the dynamic parameters of the vehicle (1);

the vehicle (1) is **characterized by** comprising two torque sensors (16), each of which is connected to the central control unit (15), is fitted to a respective axle shaft (10), and real-time detects the value of the torque

transmitted by the self-locking differential (9) to the respective rear wheel (3) via the relative axle shaft (10); the central control unit (15) controlling the regulating device (24) to regulate the lock percentage (%L) of the differential (9) as a function of the value of the torque transmitted by the self-locking differential (9) to each rear wheel (3).

25) A vehicle (1) as claimed in Claim 24, wherein each torque sensor (16) is electromagnetic, and measures electromagnetically the torsional deformation of the respective axle shaft (10) to determine the value of the torque transmitted by the axle shaft (10) to the relative rear wheel (3).

26) A vehicle (1) as claimed in Claim 24, wherein the central control unit (15) predicts time changes in the angular rotation speed of each rear wheel (3), using the value of the torque transmitted by respective axle shaft (10), and controls the regulating device (24) to regulate the lock percentage (%L) of the differential (9) as a function of future time changes in the angular rotation speed of each rear wheel (3).

27) A vehicle (1) as claimed in Claim 24, wherein the central control unit (15) estimates a target value of the lock percentage (%L) of the differential (9) as a function of the dynamic parameters of the vehicle (1), and controls the regulating device (24) by means of a feedback control loop employing as a feedback variable the value of the lock percentage (%L) of the differential

(9).

28) A vehicle (1) as claimed in Claim 27, wherein the regulating device (24) comprises a solenoid valve (31) controlled to vary the lock percentage (%L) of the differential (9), and a second sensor (37) for detecting the value of the current (I) circulating through the solenoid valve (31); the central control unit (15) controlling the regulating device (24) by means of a first control loop employing the value of the lock percentage (%L) of the differential (9) as a feedback variable, and a second control loop within the first control loop and employing as a feedback variable the value of the current (I) circulating through the solenoid valve (31).

29) A vehicle (1) as claimed in Claim 24, wherein the central control unit (15) estimates a target value of the lock percentage (%L) of the differential (9) as a function of the dynamic parameters of the vehicle (1), and controls the regulating device (24) by adding a feedback control loop employing the value of the lock percentage (%L) of the differential (9) as a feedback variable, and a direct open control loop employing the target value of the lock percentage (%L) of the differential (9) as a control variable.

30) A vehicle (1) as claimed in Claim 29, wherein the regulating device (24) comprises a solenoid valve (31) controlled to vary the lock percentage (%L) of the differential (9), and a second sensor (37) for detecting

the value of the current (I) circulating through the solenoid valve (31); the central control unit (15) controlling the regulating device (24) by means of a first control loop employing the value of the lock percentage (%L) of the differential (9) as a feedback variable, and a second control loop within the first control loop and employing as a feedback variable the value of the current (I) circulating through the solenoid valve (31).

31) A rear-drive vehicle (1) comprising:

a self-locking differential (9);

an engine (4) producing a drive torque (Tm) which is transmitted to the rear drive wheels (3) by the self-locking differential (9);

an accelerator pedal (14) which modulates the drive torque (Tm) generated by the engine (4);

a brake pedal (13) which modulates a brake torque acting on the vehicle (1);

a number of sensors (16) for real-time detecting respective dynamic parameters of the vehicle (1);

a regulating device (24) for regulating the lock percentage (%L) of the differential (9); and

a central control unit (15) for controlling the regulating device (24) to regulate the lock percentage (%L) of the differential (9) as a function of the dynamic parameters of the vehicle (1);

the vehicle (1) is **characterized in that** when cornering at substantially steady speed, the central

control unit (15) estimates the road grip of the wheels (2, 3), zeroes the lock percentage (%L) of the differential (9) when the road grip of the wheels (2, 3) is far from the grip limit, and gradually increases the lock percentage (%L) of the differential (9) when the road grip of the wheels (2, 3) nears the grip limit.

32) A vehicle (1) as claimed in Claim 31, wherein the central control unit (15) reduces the lock percentage (%L) of the differential (9) to zero when the road grip of the wheels (2, 3) is almost at the grip limit.

33) A vehicle (1) as claimed in Claim 31, wherein, as the road grip of the wheels (2, 3) nears the grip limit, the central control unit (15) gradually increases the lock percentage (%L) of the differential (9) in proportion to the value of the lateral acceleration (Ay) of the vehicle (1) and the value of the speed (V) of the vehicle (1).

34) A vehicle (1) as claimed in Claim 31, wherein the central control unit (15) zeroes the lock percentage (%L) of the differential (9) when the value of the turning angle (Dvol) of the vehicle (1) is substantially directly proportional to the value of the lateral acceleration (Ay) of the vehicle (1), and gradually increases the lock percentage (%L) of the differential (9) when no substantially direct proportion relationship exists between the value of the turning angle (Dvol) of the vehicle (1) and the value of the lateral acceleration (Ay) of the vehicle (1).

35) A vehicle (1) as claimed in Claim 31, wherein the central control unit (15) estimates the road grip of the wheels (2, 3) by estimating the value of the lateral acceleration (Ay) of the vehicle (1).

36) A vehicle (1) as claimed in Claim 31, wherein the central control unit (15) estimates the road grip of the wheels (2, 3) by estimating the value of the turning angle (Dvol) of the vehicle (1) and value of the lateral acceleration (Ay) of the vehicle (1).

37) A vehicle (1) as claimed in Claim 31, wherein, when driving along a substantially straight route, the central control unit (15) zeroes the lock percentage (%L) of the differential (9) in normal driving mode, and gradually increases the lock percentage (%L) of the differential (9) in sport driving mode.

38) A rear-drive vehicle (1) comprising:

a self-locking differential (9);

an engine (4) producing a drive torque (Tm) which is transmitted to the rear drive wheels (3) by the self-locking differential (9);

an accelerator pedal (14) which modulates the drive torque (Tm) generated by the engine (4);

a brake pedal (13) which modulates a brake torque acting on the vehicle (1);

a number of sensors (16) for real-time detecting respective dynamic parameters of the vehicle (1);

a regulating device (24) for regulating the lock percentage (%L) of the differential (9); and

a central control unit (15) for controlling the regulating device (24) to regulate the lock percentage (%L) of the differential (9) as a function of the dynamic parameters of the vehicle (1);

the vehicle (1) is **characterized in that** when driving along a substantially straight route, the central control unit (15) zeroes the lock percentage (%L) of the differential (9) in normal driving mode, and gradually increases the lock percentage (%L) of the differential (9) in sport driving mode.